

WHAT IS CLAIMED IS:

- 1 1. A filter device suitable for removing particulates from a gas
2 stream, comprising:
 - 3 a) a duct for conveying a gas stream;
 - 4 b) positioned in said duct across the flow of gas, at least one
5 electrically resistively heatable porous and conductive filter
6 element,
 - 7 c) means for providing electrical energy to said porous and
8 conductive filter element for resistively heating said porous
9 and conductive heating element.
- 1 2. The filter device of claim 1, wherein said porous, conductive
2 heating element is selected from the group of conductive foams, conductive sintered
3 particles, mesh screens, and combinations thereof.
- 1 3. The filter device of claim 1, wherein said porous, conductive
2 heating element comprises a metal foam.
- 1 4. The filter device of claim 1, wherein an interior of said duct
2 is electrically conductive, a periphery of a porous conductive filter element is
3 bonded with electrical continuity to said electrically conductive interior of said duct,
4 and a central portion of said porous conductive filter element is bonded with
5 electrical continuity to a conductive electrode positioned within said duct.
- 1 5. The filter device of claim 4, wherein said duct comprises a
2 metal tube, and said electrode comprises a metal, optionally hollow rod, an outer
3 periphery of said porous conductive filter element bonded with electrical continuity
4 to said tube, and an inner periphery of a hole within said filter element bonded with
5 electrical continuity to said metal rod.
- 1 6. The filter device of claim 1, wherein said filter element has
2 a periphery, and bonded to non-adjacent portions of said periphery are a first

3 conductive electrode and a second conductive electrode, said electrically resistively
4 heatable porous and conductive heating element providing a conductive path between
5 said first electrode and said second electrode such that said filter element is heated
6 when an electric potential is applied between said first and said second electrode.

1 7. The filter device of claim 6, wherein said duct is non-
2 conductive.

1 8. The filter device of claim 1, wherein thermal insulation
2 surrounds at least a portion of said duct.

1 9. The filter device of claim 1, wherein said filter element
2 contains a first metal electrode or is bonded with electrical continuity to a first metal
3 electrode to provide a contact area between said filter element and a first electrode
4 and to a second electrode, said filter element providing a conductive path between
5 said first and second electrodes, and wherein the line of electrical contact between
6 said filter element and said first electrode is greater in plan than the line of contact
7 of said filter element and said second electrode, and further comprising increasing
8 the thickness of said filter element from its thickness at said first electrode to a
9 greater thickness at said second electrode.

1 10. The filter device of claim 9, wherein said filter element has
2 a circular cross-section and a thickness in a direction orthogonal to said circular
3 cross-section, an outer periphery bonded to a first electrode, and a centrally located
4 hole bonded to a centrally located second electrode, the thickness of said filter
5 element increasing from its thickness at said first electrode to a greater thickness at
6 said second electrode.

1 11. A process for the filtration of a gas stream comprising
2 thermally deactivatable particulates, comprising:

- 3 a) providing a filter device of claim 1, and
4 b1) heating one or more of said at least one filter element(s) of
5 said filter device by passing an electric current through said

- 6 one or more filter elements to provide one or more heated
7 filter elements, and
8 c1) passing said gas through said one or more heated filter
9 elements; and/or
10 b2) passing said gas through said one or more filter elements of
11 said filter device, thereby trapping particulates on one or
12 more filter elements, and
13 c2) heating at least one of said one or more filter elements to a
14 high temperature sufficient to destroy particulates trapped
15 thereon or to render pathogens trapped thereon non-viable,
16 and
17 d) obtaining from an exit of said filter device a gas stream
18 depleted of particulates and/or viable pathogens.

1 12. The process of claim 11, wherein said filter device is
2 employed to filter a stream of gas containing or potentially containing at least one
3 pathogenic microorganism, and wherein at least one filter element is resistively
4 heated to a temperature such that the microorganisms are rendered non-viable.

1 13. The process of claim 12, wherein said microorganism is one
2 or more selected from the group consisting of those causing the symptoms of
3 anthrax, SARS, tuberculosis, smallpox, pneumonia and ebola.

1 14. The process of claim 12, wherein said filter device is
2 positioned in an exhaust stream of an internal combustion engine.

1 15. The process of claim 14, wherein said internal combustion
2 engine is a diesel engine.

1 16. The process of claim 12, wherein heated gas exiting said filter
2 device is routed through a heat exchanger and a gas stream to be passed through said
3 filter device is also routed through said heat exchanger, said gas stream being heated
4 and said heated gas being cooled by transfer of heat in said heat exchanger.